

CANADIAN PETROLEUM ASSOCIATION

**Options for
Integrated Resource Management
in the Mackenzie Delta
- Beaufort Sea Region**

**Prepared for the
Canadian Petroleum Association
Calgary, Alberta**

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EXECUTIVE SUMMARY

Following the recent completion of a draft land use plan for the Mackenzie delta - Beaufort Sea region, the Canadian Petroleum Association (CPA) expressed a number of concerns related to the focus of the land use planning process and the plan's assessment of the petroleum industries activities. In light of the petroleum industry's long operational history, and the large number of environmental protection measures that have been developed and successfully employed in the region, the CPA believes that the plan should address mechanisms for integrated land use planning, as well as the establishment of protected areas. The recently proposed land management regimes are an excellent basis for future discussion and development of a comprehensive land use system.

This review summarizes examples of consultative activities and environmental protection measures that have been employed in the planning region by one or more petroleum operators to successfully achieve integrated land use during the past two decades. This summary is not intended as an exhaustive list of routine procedures that have been or that will be used by all operators during all projects. Instead, the purpose of the summary is to (1) illustrate how petroleum operators, in cooperation with local residents and communities, have planned and adapted specific aspects of different projects to address and resolve environmental and community concerns; and (2) provide an overview of the measures that can be employed to achieve integrated land use planning guidelines for future projects.

Because of the importance of renewable resources to local residents, the review of environmental protection procedures focuses on specific groups of renewable resources and the applicable measures that have been used to reduce industrial impacts to these resources.

Community consultation processes in the planning region have been successfully used by local residents, government and industry to identify concerns associated with petroleum projects, and develop appropriate measures to address and resolve these concerns. Components of the consultation process include community consultation before, during and after project construction and operation, distribution of information materials, cross-cultural training, and the negotiation of compensation agreements.

Environmental protection planning measures are described for cultural and historical resources, air quality, noise, freshwater quality, marine water quality, terrain and soils, fisheries, and terrestrial and marine wildlife. General measures, as well as specific protection procedures such as the beluga whale protection plan and oil spill contingency plans are discussed.

Although some environmental accidents have occurred during petroleum exploration and drilling activities in the planning region, evidence suggests that petroleum activity has been able to proceed with no detectable, long-term impacts to the environment. This degree of success has been the result of several factors:

- the broad knowledge of local residents on environmental and cultural resources, and the cooperation of local resident and governments in identifying and resolving impacts that may occur with specific petroleum activities;

- the establishment of a comprehensive scientific data base on the environment (biological and physical resources);
- the close link between good environmental practice and minimizing long-term operational costs;
- the cooperative efforts of professional biologists, engineers, and planners, as well as local residents in developing and refining environmental protection measures;
- the success of recent cross-cultural training initiatives; and
- ongoing consultative processes among local resident, organizations, territorial and federal governments, and industry.

Based on established practices of the petroleum industry in the planning region, the use of procedural, locational and timing constraints on some land use activities, as proposed by the Commission, is very similar to environmental protection planning procedures now in use. A number of examples of similarities between established practices of the petroleum industry and the proposed land management regimes are provided.

As a result of the uncertainty for long-term economic diversification in the planning region, and the integral nature of renewable resources to traditional lifestyles, it is recognized that protection and conservation of renewable resources is of critical importance to local residents. Future economic development in the planning region must ensure that the environmental and cultural resources of the region are sustained.

Given the success of local communities and the petroleum industry in consultative programs and environmental planning during the past decade, it is concluded that:

1. Ongoing consultative processes involving local residents, agencies and governments, the territorial and federal governments and the petroleum industry are essential to the future resolution of potential conflicts and effective land use decisions in the planning region.
2. Recognizing the protected areas in the draft land use plan, these consultative processes should be used to develop conservation plans and land use guidelines for these areas that are acceptable to local residents, industry and governments. The proposed land management regimes offer an excellent base for development of effective multiple land use guidelines.
3. Environmental protection measures must continue to be effectively employed in all aspects of oil and gas developments. Whenever possible, input from local residents, scientists and industry specialists should be used to improve existing techniques and to develop new procedures for environmental protection.

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ACKNOWLEDGEMENTS

During the past three decades, a large volume of information has been amassed on oil and gas activities, environmental resources and northern cultural values in the Mackenzie Delta - Beaufort Sea region. Given the short time frame for this review, the completion of this report would not have been possible without the assistance of a number of individuals in identifying important information sources, and in freely giving of their time to discuss important aspects of petroleum development and the environment in the study region. Persons contacted during this review are listed in Table 1. I would also like to thank Tom Beck of the Land Use Planning Commission, for helpful suggestions on the approach to and contents of this review.

1.0 INTRODUCTION

1.1 BACKGROUND

In 1987, the Mackenzie Delta - Beaufort Sea Regional Land Use Planning Commission (the Commission) initiated a land use planning process for the Canadian Beaufort Sea and Mackenzie Delta region (Figure 1) (Mackenzie Delta - Beaufort Sea Regional Land Use Planning Commission 1990 a,b). In May 1990, a draft land use plan was completed for review by residents, industry, governments and other interests.

The Mackenzie Delta - Beaufort Sea planning region includes both private and public lands. Through the Inuvialuit Final Agreement (IFA), the Inuvialuit own over 9,000 square kilometers of land. The Gwich'in Tribal Council is currently negotiating with the federal government for ownership and control of other lands in the planning region. Several additional areas have been incorporated into the planning area to include the calving grounds of the Bluenose caribou herd, and areas of interest to residents of Fort MacPherson and Arctic Red River.

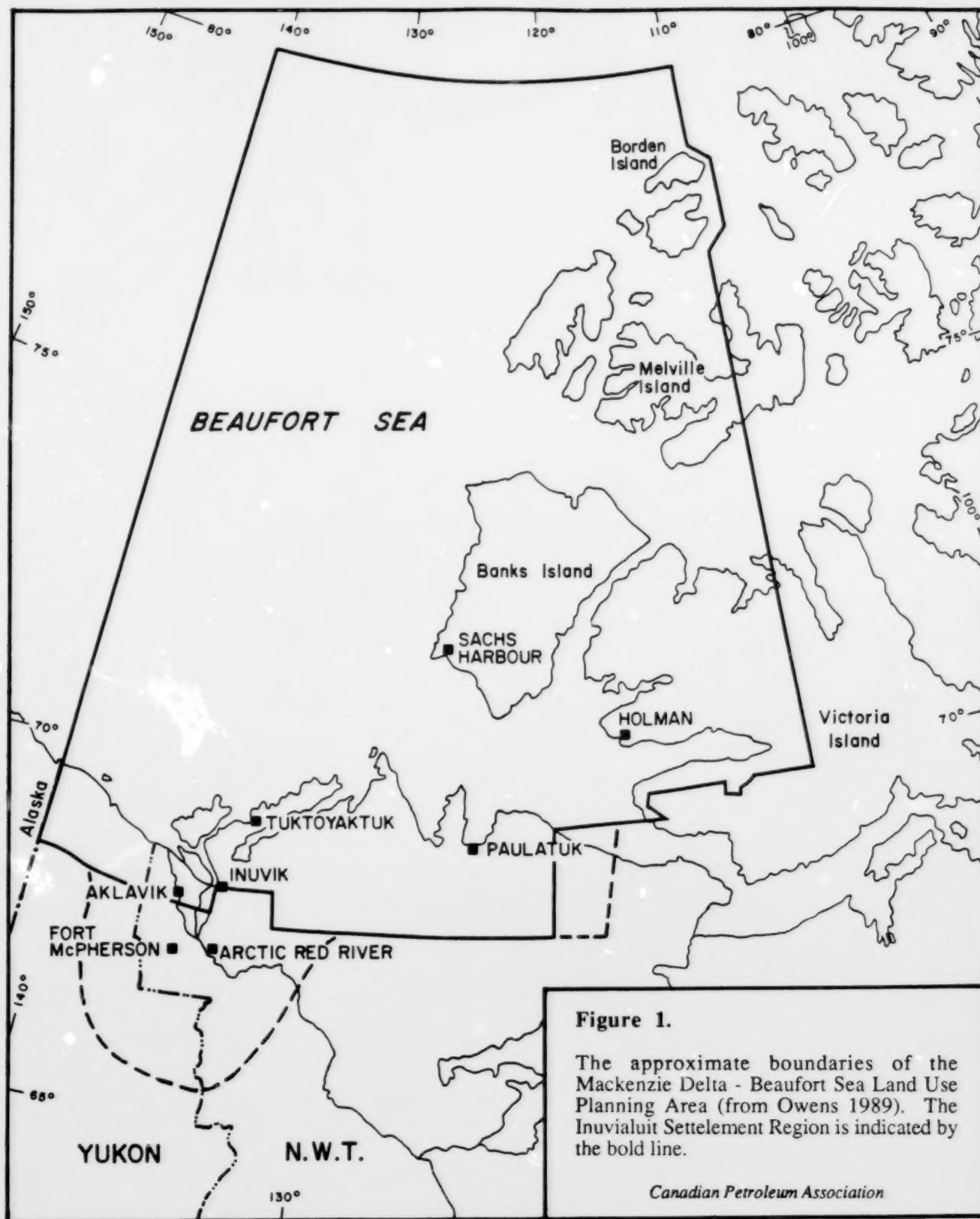
Because native peoples in the planning region have practiced sustainable use of renewable resources in their traditional lifestyles, regional land use planning is based on an underlying theme of renewable resource conservation to sustain the region's lifestyles and culture (Mackenzie Delta - Beaufort Sea Regional Land Use Planning Commission 1990). Industrial and commercial developments in the planning region, regardless of their emphasis on either renewable or non-renewable resources, must be in harmony with the conservation of renewable resources and traditional uses of these resources.

Based on its land use planning process, the Commission concluded that many land use issues in the planning region can be resolved by applying three basic principles in land use decision making:

1. Communities must actively participate in the land use decision making process;
2. Where possible, the land use process should strive towards effective and integrated resource management; and
3. Information on land use and land use planning must be widely accessible to land users, managers and decision-makers.

In order to implement the plan, the Commission suggests that a land management system be developed which will guide decisions about when, where and how land use will proceed. Community conservation plans should then be developed for these protected areas to provide community-based direction on land use.

During the fall 1990, the Commission prepared a draft system of land management which defined the classes of land ownership within the region, as well as proposed land management regimes for the Mackenzie Delta - Beaufort Sea planning region. The proposed regimes were:



- **Group A:**
Multiple use lands where there are no particular significant or sensitive cultural or renewable resources; therefore, activities/development can proceed subject to current regulatory applications for multiple-use activities.
- **Group B:**
Multiple use lands where the cultural or renewable resources are significant or sensitive throughout the year, but where activities/development can proceed subject to the identification of special measures during the regulatory application process to ensure the conservation of these values.
- **Group C:**
Multiple use lands where cultural or renewable resources are significant or sensitive at particular seasons or times; therefore, activities/development should only proceed at other times of the year. Subsistence harvesting is permitted at any time of the year.
- **Group D:**
Limited use lands where cultural or renewable resources are very significant or sensitive year-round; therefore activities/development are not permitted that would threaten conservation of these cultural or renewable resources. Subsistence harvesting is permitted at any time of the year.
- **Group E:**
Limited use lands where cultural or renewable resources are extremely significant or sensitive; therefore no human activity is permitted, including tourism. Subsistence harvesting is suspended for public safety or conservation in accordance with IFA and Dene/Metis Agreements. Limited research is permitted.

These proposed land management regimes were the focus of discussion during the land use planning workshop in Inuvik during early December 1990.

1.2 RESPONSE OF THE CANADIAN PETROLEUM ASSOCIATION TO THE DRAFT LAND USE PLAN

Since 1987, the Canadian Petroleum Association (CPA) has provided substantive input to the Mackenzie Delta - Beaufort Sea Land Use Planning Process (see Owens 1988, 1989). Following review of the draft land use plan for the Mackenzie Delta - Beaufort Sea planning region, the CPA identified a number of concerns in relation to the direction and emphasis of the planning process, and the conclusions of the plan in relation to oil and gas exploration and development. As discussed in the CPA letter to the Commission in July 1990, the major concerns are:

1. The emphasis on **land protection** and preservation rather than integrated or multiple use;
2. The focus of the plan on management of renewable resources, in contrast to only limited discussion on non-renewable resources;
3. A need to address the potential effects of hydrocarbon development on renewable resources in light of both traditional and scientific knowledge;

4. The Commission's assessment of the petroleum industry's spill response status;
5. The assessment of current ocean dumping practices and regulations; and
6. The need to define how absolute and seasonal protection plans for protected areas will be developed and how potential land use conflicts will be resolved (CPA 1990).

In light of the petroleum industry's long operational history in the region and its efforts to cooperate and consult with local residents, the CPA feels that the draft planning document does not adequately address options or mechanisms for integrated land use planning in the region. However, recent recommendations of the Commission for land management regimes (see above), provide an excellent basis for discussion of multiple land use and land use restrictions.

1.3 OBJECTIVES OF THIS REVIEW

In discussions of the CPA's concerns, the Commission has suggested that the CPA compile a summary of site- and activity-specific procedures for integrated land use activities that are currently or likely to be used by the petroleum industry in the planning region. The summary would identify environmental protection planning procedures that have been successfully employed in the Mackenzie Delta - Beaufort Sea region over the past two decades. Relevant procedures for petroleum and pipeline developments outside the planning region, as well as new procedures that may be effective in the planning region would also be discussed.

The Delta Environmental Management Group was retained by the CPA to compile a summary report on options for integrated land use planning and management in the Mackenzie Delta - Beaufort Sea Land Use Planning Region. The objectives of the review were to:

1. Review the land use planning documents and industry input on the planning process and draft plan;
2. Interview CPA members to identify their specific areas of concern, the range of industrial activities, and options for resolution of land use conflicts;
3. Identify options for specific issues or areas of concern; and
4. Prepare a working document for use in the land use planning workshop scheduled for December 1990.

2.0 APPROACH

2.1 INFORMATION COLLECTION

Information on industrial activities and options for integrated land use was obtained primarily through interviews with experienced staff of oil and gas companies that are active, have been active or may be active in the planning region (Table 1). Where possible, published reports and material were used to provide details on specific procedures for integrated land use.

2.2 ORGANIZATION OF THE REVIEW

Two major types of procedures for integrated land use were reviewed:

- **Consultative and decision-making processes**
Since the start of petroleum exploration and drilling activities in the planning region, consultative processes have advanced considerably. These evolving processes, particularly the active participation of communities and local residents in the decision-making process for project design and implementation, have become the cornerstone of successful land use planning for oil and gas activities. The continuation and further development of these cooperative processes is essential to future petroleum activities in the region.
- **Environmental protection planning procedures**
Through industry and government funded research programs, input from local residents, and industry experience, a large number of procedures have been developed and successfully implemented to minimize or eliminate significant impacts to cultural and archaeological resources, ambient noise levels, air and water quality, terrain and soils, freshwater fisheries, wildlife, and marine habitats.

In addition, to these procedures, federal and territorial legislation strictly regulates routine operations for oil and gas exploration and production, as well as the use, handling and disposal of routine and hazardous wastes. The petroleum industry has also cooperated with government agencies in the development and acceptance of new methods and regulations for waste management.

Table 1. Name and affiliations of persons interviewed during the review of options for integrated resource management.

Name	Affiliation	Date of Meeting/Telephone Discussion
Terry Antoniuk	Gulf Canada Resources	Multiple Contacts
Phil Airhart	Interprovincial Pipeline Company	24 October 1990
Evan Birchard	ESSO Resources Canada Limited	Multiple telephone contacts
Carl Bonke	Shell Canada	25 October 1990
Douglas Clark	Gulf Canada Resources	25 October 1990
Peter Devinis	Gulf Canada Resources	Multiple Contacts
John Hayes	Interprovincial Pipeline Company	Multiple Telephone Contacts
Rick Hoos	Polar Gas	10 October 1990
Rob Owens	Foothills Pipe Lines Ltd.	17 October 1990
Ted Spearing	Chevron Canada Resources	25 October 1990
David Townsend	Gulf Canada Resources	25 October 1990
John Ward	Amoco Canada Ltd.	13 November 1990

3.0 EXISTING OPTIONS FOR INTEGRATED RESOURCE MANAGEMENT

As of 1990, petroleum activity in the planning region has involved seismic and exploration drilling programs in the Mackenzie Delta, and the nearshore and offshore areas of the Beaufort Sea. In the future, oil and gas production and transportation projects are also likely to be undertaken.

In the following section, measures are described that have been successfully used or that are likely to be used during one or more oil and gas projects to integrate the industry's activities with conservation and protection of renewable resources. This summary is not intended as an exhaustive list of routine and specialized procedures that have been or that will be used by all operators during all projects. Instead, the purpose of the summary is to (1) illustrate how petroleum operators, in cooperation with local residents and communities, have planned and adapted specific aspects of different projects to address and resolve environmental and community concerns; and (2) provide an overview of the measures that can be employed to achieve integrated land use planning guidelines for future projects.

Because oil and gas production and transportation projects have not yet been undertaken in the planning region, the review of existing environmental protection procedures is largely based on measures that have been utilized with seismic and exploration drilling programs. Examples of environmental protection procedures that are likely to be used in conjunction with gas and oil production and transportation are based largely on existing projects in the southern Northwest Territories, northern Alberta and northern Saskatchewan (e.g., the IPL Norman Wells - Zama Lake pipeline).

Due to the importance of local input to project design and implementation, consultative processes are discussed first. Because of the importance of renewable resources to the traditional lifestyles and culture of residents in the planning region, the remainder of the review focuses on specific groups of renewable resources (air, freshwater quality, marine water quality, terrain and soils, fisheries, terrestrial wildlife, and marine wildlife), and applicable procedures for reducing impacts of petroleum activities on these resources.

A matrix summary has been developed to provide a tabular index to the types of procedures that have or will be employed to reduce or eliminate impacts to specific groups of renewable resources (Table 2).

3.1 COMMUNITY CONSULTATION AND INFORMATION

Consultation with local organizations and residents has become an important component of most oil and gas development projects in the Mackenzie Delta - Beaufort Sea planning region and adjacent areas (e.g., IPL 1987a, 1988, 1989; Gulf Canada Resources 1990a). The amount and depth of community consultation depends on the community's needs and concerns, and the type and schedule of project being proposed. Consultation commonly begins prior to or during the conceptual design of a project (i.e., pre-application). For exploration programs, this could take from 1 to 12 months, whereas for production, pre-approval consultation could take place over 3 to 5 years. Once regulatory approval is received, consultation continues throughout project construction and operation to report progress and deal with any unanticipated issues. Although only exploration

Table 2. Summary of environmental protection measures that have been or that may be employed to reduce or eliminate impacts to specific types of renewable resources in the Mackenzie Land Use Planning Area. (Not Applicable [NA] indicates that no important interactions are expected to occur between the project activity and the specific resource).

Resource Group	Seismic Exploration	Exploration Drilling (Land)	Exploration Drilling (Marine)	Oil & Gas Production	Pipelines	Facilities and Camps	Aircraft	Vessels
Cultural and Historical Resources	• screening of project by gov't regulators and agencies • use of a professional archaeologist when important concerns are identified in exploration area • consultation with local residents and organizations to avoid conflicts with important sites and harvesting activities • location of camps, work areas and travel routes away from major settlements • cross-cultural training	• screening of project by gov't regulators and agencies • use of a professional archaeologist when important concerns are identified in exploration area • consultation with local residents and organizations to avoid conflicts with important sites and harvesting activities • location of camps, work areas and travel routes away from major settlements • cross-cultural training	• screening of project by gov't regulators and agencies • consultation with local residents and organizations to avoid conflicts with important sites and harvesting activities • location of camps, work areas and travel routes away from major settlements • cross-cultural training	• screening of project by gov't regulators and agencies • use of a professional archaeologist during site location • consultation with local residents and organizations to avoid conflicts with important sites and harvesting activities • location of camps, work areas and travel routes away from major settlements • cross-cultural training	• screening of project by gov't regulators and agencies • use of a professional archaeologist during pipeline routing and construction • consultation with local residents and organizations to avoid conflicts with important sites and harvesting activities • location of camps, work areas and travel routes away from major settlements • cross-cultural training	• screening of project by gov't regulators and agencies • use of a professional archaeologist during site location • consultation with local residents and organizations to avoid conflicts with important sites and harvesting activities • location of camps, work areas and travel routes away from major settlements • cross-cultural training	• screening of project by gov't regulators and agencies • consultation with local residents and organizations to avoid low overflights of harvesting sites during periods of peak harvest • use of aircraft corridors and minimum flight altitudes to minimize conflicts with waterfowl & whale harvest • cross-cultural training	• screening of project by gov't regulators and agencies • consultation with local residents and organizations to avoid vessel movements in harvesting areas during periods of peak harvest • modification of vessel routes and operation to minimize conflicts with whale harvest • cross-cultural training
Air Quality	• screening of project by gov't regulators and agencies	• screening of project by gov't regulators and agencies • use of emission technology	• screening of project by gov't regulators and agencies • use of emission technology	• screening of project by gov't regulators and agencies • use of emission technology	• screening of project by gov't regulators and agencies • use of emission technology	• screening of project by gov't regulators and agencies	• screening of project by gov't regulators and agencies	• screening of project by gov't regulators and agencies
Noise	• screening of project by gov't regulators and agencies	• screening of project by gov't regulators and agencies	• screening of project by gov't regulators and agencies	• screening of project by gov't regulators and agencies • use of noise suppression measures to reduce noise levels at project boundary (e.g., facility construction and location)	• screening of project by gov't regulators and agencies • use of noise suppression measures to reduce compressor and high pressure pipe noise • compressor stations will be located away from communities	• screening of project by gov't regulators and agencies • use of noise suppression measures to reduce noise levels at project boundary (e.g., facility construction and location)	• screening of project by gov't regulators and agencies • use of aircraft corridors and minimum flight altitudes to minimize ground level noise	• screening of project by gov't regulators and agencies • use of low noise props and hull designs to minimize underwater noise
Freshwater Quality	• screening of project by gov't regulators and agencies • maintenance of vegetation buffer areas • guidelines for refueling and equipment maintenance (e.g., away from water) • hazardous waste management (see Facilities and Camps) • stream crossings on snow fills that maintain flows • removal of snow fills before breakup	• screening of project by gov't regulators and agencies • preferential use of non-toxic drilling mud additives and reduction of mud volumes • use of bio-degradable rig washing compounds • spill containment structures on drill platforms • location of drill rigs away from watercourses and water bodies • use of small deep sumps • recycling of muds; treatment of mud wastes to meet or better gov't guidelines • testing and treatment of sump fluids	• N/A	• screening of project by gov't regulators and agencies • maintenance of high equipment and operational standards • precautionary training for all operational personnel • use of specialized equipment during fueling • maintenance of containment berms and site drainage systems • development of oil spill contingency plans, and regular practice drills • establishment and support of oil spill cooperatives	• screening of project by gov't regulators and agencies • minimize in-stream activity • spoil handling and storage to minimize sedimentation • maintenance of vegetation buffer areas • directional drilling under some major river crossings • restrictions on water withdrawals and discharges for hydrostatic testing • scheduling of construction to minimize effects of remaining water quality changes (e.g., sedimentation) to fish during critical life phases	• screening of project by gov't regulators and agencies • primary and secondary treatment of sewage • control and handling of solid wastes (food, non-combustible garbage) • washing and crushing of metals drums for recycling • no direct disposal of hazardous wastes; oily wastes treated and incinerated. Waste glycol often recycled. Waste chemicals packaged and transported to southern waste treatment facilities.	• screening of project by gov't regulators and agencies • spill prevention precautions during refueling	• screening of project by gov't regulators and agencies • no direct disposal of hazardous wastes; oily waste treated and incinerated. Waste glycol often recycled. Waste chemicals packaged and transported to southern waste treatment facilities.

Table 2. Summary of environmental protection measures that have been or that may be employed to reduce or eliminate impacts to specific types of renewable resources in the Mackenzie Land Use Planning Area. (Not Applicable [NA] indicates that no important interactions are expected to occur between the project activity and the specific resource).

Resource Group	Seismic Exploration	Exploration Drilling (Land)	Exploration Drilling (Marine)	Oil & Gas Production	Pipelines	Facilities and Camps	Aircraft	Vessels
Freshwater Quality (continued)		• isolation of freshwater zones from potential hydrocarbon bearing zones • containment and disposal of all formation fluids obtained from well testing operations • fuel stored in bermed, lined containment areas • waste engine oil, lube oil, fuel, etc., stored in drums and disposed of per regulations. • equipment, procedures and training to minimize risk of a blowout • development of oil spill and relief well contingency plans, and regular practice drills • establishment and support of oil spill cooperatives						
Marine Water Quality	• screening of project by gov't regulators and agencies • guidelines for fuel storage refueling and equipment maintenance • hazardous waste management (see Facilities and Camps)	• N/A	• screening of project by gov't regulators and agencies • solid and liquid waste management guidelines specified in federal legislation • treatment and disposal of routine and hazardous wastes as per regulations. • preferential use of non-toxic drilling mud additives and reductions in mud volumes • treatment and discharge of well cuttings and spent mud to meet or better guidelines; no above ice disposal • equipment design and operating procedures and staff training to minimize blowout risk • relief well and oil spill contingency plans and regular practice drills • establish spill response cooperative • compilation of shoreline sensitivity atlas, videos, etc.	• screening of project by gov't regulators and agencies • solid and liquid waste management guidelines specified in federal legislation • treatment and disposal of routine and hazardous wastes as per regulations.	• screening of project by gov't regulators and agencies • maximize protection of pipeline integrity • bury pipeline to protect against ice scouring	• screening of project by gov't regulators and agencies • solid and liquid waste management guidelines specified in federal legislation • treatment and disposal of routine and hazardous wastes as per regulations.	• screening of project by gov't regulators and agencies • spill prevention precautions during refueling	• screening of project by gov't regulators and agencies • solid and liquid waste management guidelines specified in federal legislation • treatment and disposal of routine and hazardous wastes as per regulations. • spill prevention precautions during refueling

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Resource Group	Seismic Exploration	Exploration Drilling (Land)	Exploration Drilling (Marine)	Oil & Gas Production	Pipelines	Facilities and Camps	Aircraft	Vessels
Terrain and Soils	• screening of project by gov't regulators and agencies • maximize use of existing seismic lines and ROWs, particularly in forested areas • route seismic lines to avoid erosion prone soils and terrain • seismic activity conducted during winter • restriction of vehicle traffic to ice roads, existing ROWs, and seismic lines • protect organic mat through use of special equipment (e.g., low pressure tires, cleat pads) and winter use only	• screening of project by gov't regulators and agencies • maximize use of existing access • locate drill sites to avoid sensitive terrain and soils • no overland rig movements in summer • use of wooden pilings/platforms, rig matting, geotextile fabrics and ice platforms to reduce gravel needs and ground disturbance • fuel stored in bermed, lined containment areas • special measures to protect permafrost such as cooling of drilling fluids, and use of insulation. • reclamation techniques for abandoned drill sites	• N/A	• screening of project by gov't regulators and agencies • maximize use of existing access and facility sites • locate facilities to avoid erosion prone soils and terrain • most construction activity will be completed during winter • restriction of vehicle traffic to ice roads and ROW • special measures to protect permafrost areas • directional drilling reduces the number of drill platforms required • development and improvement of reclamation technology for northern areas.	• screening of project by gov't regulators and agencies • maximize use of existing access and ROWs • route pipelines to avoid erosion prone soils and terrain • most construction activity will be completed during winter; use of river and air access in summer • restriction of vehicle traffic to ice roads and ROW • special measures to protect permafrost areas (e.g., wood chips, refrigeration of lines) • where possible, maintenance of natural drainageways across or adjacent to the ROW • where feasible, topsoil salvage and storage • development and improvement of reclamation technology	• screening of project by gov't regulators and agencies • maximize use of existing access and facility sites • locate facilities to avoid erosion prone soils and terrain • most construction activity is or will be completed during winter • restriction of vehicle traffic to ice roads and ROW • special measures to protect permafrost areas • where feasible, topsoil salvage and storage • development and improvement of reclamation technology for northern areas.	• N/A	• N/A
Fisheries	• screening of project by gov't regulators and agencies • scheduling of activity to avoid sensitive periods for fish • minimize ROWs through critical fish habitat • measures to maintain water quality (e.g., vegetation buffer zones) • no explosive charges within 15 m of freshwater bodies that do not freeze to the bottom	• screening of project by gov't regulators and agencies • where possible, scheduling of activity to avoid sensitive periods for fish • avoidance of drill pad placement in or adjacent to critical fish habitat • measures to maintain water quality (e.g., vegetation buffer zones) • preferential use of non-toxic drilling mud additives • maintenance of water quality through measures described above • training of personnel to minimize risk of fuel spills • oil spill contingency plans	• screening of project by gov't regulators and agencies • avoidance of drill pad placement in sensitive nearshore habitats • training of personnel to minimize spills of hazardous materials into water • containment of spills from routine operations on the rig (e.g., stack flaring) • water quality protection measures as described above • identification and prioritization protection measures for critical and sensitive habitats (e.g., Beaufort atlas)	• screening of project by gov't regulators and agencies • avoidance of facility construction adjacent to critical fish habitats • measures to maintain water quality (e.g., vegetation buffer zones, handling of routine wastes, disposal of hazardous waste) as described above	• screening of project by gov't regulators and agencies • scheduling of construction activity to avoid critical time periods for fish • routing of the pipeline to minimize stream crossings and disturbance of fish habitat • measures to maintain fish passage during construction and under ice roads • measures to maintain water quality (e.g., vegetation buffer zones) during construction	• screening of project by gov't regulators and agencies • avoidance of facility construction adjacent to critical fish habitats • measures to maintain water quality (e.g., vegetation buffer zones, handling of hazardous wastes) • cross-cultural training to minimize problems such as over-fishing	• N/A	• screening of project by gov't regulators and agencies • solid and liquid waste management guidelines specified in federal legislation • treatment of routine and hazardous wastes onshore

Table 2. Summary of environmental protection measures that have been or that may be employed to reduce or eliminate impacts to specific types of renewable resources in the Mackenzie Land Use Planning Area. (Not Applicable [NA] indicates that no important interactions are expected to occur between the project activity and the specific resource).

Resource Group	Seismic Exploration	Exploration Drilling (Land)	Exploration Drilling (Marine)	Oil & Gas Production	Pipelines	Facilities and Camps	Aircraft	Vessels
Terrestrial and Marine Mammals	• screening of project by gov't regulators and agencies • avoidance of seismic lines and/or activity in critical wildlife habitats during sensitive time periods • restriction of vehicle movements on ROW • control and handling of solid and hazardous wastes and staff training and control (see Facilities and Camps) • use of air guns instead of explosives for energy source in marine areas • no feeding of wildlife • non-injurious bear deterrence techniques	• screening of project by gov't regulators and agencies • avoidance of drill pads and/or activity in critical wildlife habitats during sensitive time periods • control and handling of solid and hazardous wastes and staff training and control (see Facilities and Camps); • development of oil spill contingency plans for land spill and spills in fresh water • development of protection procedures for waterbirds and wetland/riparian habitat in the event of an oil spill • no feeding of wildlife • non-injurious bear deterrence techniques	• screening of project by gov't regulators and agencies • control and handling of solid and hazardous wastes and staff training and control (see Facilities and Camps); • oil spill contingency plans to contain and remove oil and to protect shoreline habitat • development of a protection plan for coastal birds • development of a protection plan for white whales and the white whale harvest • development of a polar bear protection plan • non-injurious bear deterrence techniques	• screening of project by gov't regulators and agencies • control and handling of solid and hazardous wastes and staff training and control (see Facilities and Camps); • oil spill contingency plans to contain and remove oil and to protect shoreline habitat • development of a protection plan for marine and coastal birds • development of protection procedures for waterfowl habitat • development of a protection plan for white whales and the white whale harvest • development of a polar bear protection plan • no feeding of wildlife • non-injurious bear deterrence techniques	• screening of project by gov't regulators and agencies • avoidance of pipeline routings through critical wildlife habitat • scheduling of pipeline construction to avoid sensitive time periods for wildlife • in some forested areas, dog-legs may be used at pipeline crossings of ROWs to screen the pipeline approach • restriction of vehicle movements on ROW; use of vehicle convoys • control and handling of solid and hazardous wastes and staff training and control (see Facilities and Camps); • avoidance of raptor nests during inspection patrols • procedures to minimize blockage of wildlife movements by pipe strings, berms and ditches • no feeding of wildlife • non-injurious bear deterrence techniques	• screening of project by gov't regulators and agencies • location of facilities and camps way from critical habitat areas • no feeding of wildlife • careful handling and disposal of food wastes to minimize attraction of wildlife • control of hazardous waste storage and disposal. • restrictions on use of firearms on company time and property • northern training for all southern personnel • hiring of local residents as wildlife monitors • non-injurious bear deterrence techniques	• screening of project by gov't regulators and agencies • restrictions on flight corridors and altitudes to minimize disturbance of beluga whales and waterfowl, as well as local harvesting activities. (e.g., beluga whale protection plan, bird protection plan) • guidelines to minimize interactions between beluga whales and movements of icebreakers and drill vessels, particularly during late June to early August	• screening of project by gov't regulators and agencies • guidelines to minimize interactions between beluga whales and movements of icebreakers and drill vessels, particularly during late June to early August

projects have been completed through to abandonment and reclamation, companies would also continue consultation through this phase for production and transportation projects.

3.1.1 Pre-Approval Consultation

All of the major oil and gas companies contact community organizations and governments prior to the receipt of regulatory approvals to ensure that:

- community residents are informed in a timely fashion of potential seismic and exploration drilling programs and other developments,
- concerns of the community for environmental and socio-economic impacts are identified, and
- community input is obtained on methods to eliminate or reduce these concerns through measures such as locational and timing constraints.

Meetings have normally included the Hunters and Trappers Committees (HTCs), Hunters and Trappers Associations (HTAs), the Inuvialuit Game Council (IGC), the Joint Secretariat, the Fisheries Joint Management Committee (FJMC), the Wildlife Management Advisory Council (Northwest Territories) (WMAC/NWT), the Wildlife Management Advisory Council (North Slope) (WMAC/NS), the Gwich'in Tribal Council and/or local municipal governments (e.g., hamlet councils). In cases where individual trappers or hunters may be affected, one-on-one consultation also occurs.

In several instances, local residents have helped design environmental studies to obtain specific information on environmental resources, monitor potential impacts of a project on biological resources, or develop methods to reduce potential project impacts (e.g., the ESSO polar bear protection plan).

3.1.2 Consultation During Construction and Operations

Local residents have helped locate specific facilities or establish appropriate timing windows for seismic and exploration drilling programs to minimize effects on specific renewable resources. For example, HTCs have been contacted prior to a number of offshore exploration projects to identify any changes in the timing and location of activities to minimize or eliminate interference with the beluga whale hunt (e.g., Dome Petroleum et al. 1986; Gulf Canada Resources 1990b). In areas upstream of the planning region, local residents have been involved in identifying local modifications to the locations for seismic lines, and in monitoring impacts of seismic lines on wildlife such as moose (IPL 1987a). All of the proposed pipeline projects in the planning region indicated that pipeline routing would involve substantial input by local organizations and residents on project siting and timing.

Local representatives have been employed in several projects as environmental monitors to ensure that project construction and operations do not interfere with important wildlife habitat, movement corridors, harvest activities, traplines and hunting camps (e.g., IPL 1987a, n.d.[a]). Several companies have hired local people as harbour monitors to observe operational activities and serve as a liaison with the communities. Almost all offshore and nearshore projects employ local people as polar bear monitors. Several projects have invited local residents to tour their operations and provide input on environmental protection measures.

3.1.3 Post-Project Consultation

Following the completion of seismic and exploration drilling projects, oil and gas companies have completed community consultation programs to brief local residents on the

outcome of the project and, where major site disturbances have occurred, the methods and timing of reclamation activities for site abandonment. Community consultation is also expected to continue throughout the decommissioning and site abandonment phases for major production facilities and pipelines. Where concerns exist for specific environmental resources or geotechnical effects (e.g., slope stability), post-project monitoring may also be implemented. For example, in conjunction with the IPL Norman Wells - Zama Lake pipeline, local residents have been annually briefed on monitoring activities and results along the pipeline ROW (IPL 1987a, 1988, 1989).

3.1.4 Information Materials

For major projects such as the Norman Wells - Zama pipeline, information brochures have been developed for distribution to local residents (e.g., IPL n.d. [a,b,c]). Booklets have addressed issues such as potential environmental impacts and mitigation measures, oil spill containment and recovery programs, and project descriptions.

3.1.5 Cross-Cultural Training

All of the major oil and gas companies provide some form of cross-cultural training to their employees to better understand and respect the traditional and cultural values of northern peoples. Where local communities so desire, companies will locate their camps and major access routes away from local communities to minimize disturbances of local residents and social impacts on traditional lifestyles.

3.1.6 Compensation Policies

Further to the Inuvialuit Final Agreement, all major developers must negotiate a compensation agreement for residents who may be affected by the project. Agreements have been established with the Inuvialuit Game Council that specify the types of effects that will be compensated, claims procedures, and the method of determining settlements. The same compensation measures will also apply to other hunters and trappers in the planning region.

3.2 ENVIRONMENTAL PROTECTION PLANNING PROCEDURES

3.2.1 Measures to Protect Cultural and Historical Resources

Major oil and gas projects can affect cultural and historical resources through the physical activities of construction, as well as through the influx of large numbers of southern residents into northern communities and traditional harvesting areas. Protection measures for cultural and historical resources that are routinely employed by major oil and gas companies in or adjacent to the planning region (e.g., TransCanada Pipelines 1986; Foothills Pipe Lines n.d.; Polar Gas n.d.) include:

- Screening of all Projects by Government Regulators and Agencies
In recognition of the importance of archaeological and historical resources within the planning region, all oil and gas developments are coordinated with the Northern Heritage Centre to ensure that these resources are not destroyed or damaged by project activities.
- Retainer of a Professional Archaeologist
Potential producing facility sites and pipeline routings are or will be inspected by a professional archaeologist prior to any construction activities to determine if archaeological or historical sites or artifacts will be destroyed or damaged by the project. An archaeologist may also be retained during construction to supervise construction and assess any finds.

- Consultation with Local Residents, HTC's, and HTAs
Project plans are reviewed by local residents and regulators to ensure that important cultural or historical sites are not disturbed. Modifications to the locations and timing of the project can often be developed to eliminate impacts to cultural and historical resources.
- Cross-cultural Training
Most oil and gas personnel from southern regions complete cross-cultural training sessions to increase their awareness of traditional northern lifestyles, history and geography, the importance of cultural and historical sites, and the legal penalties for disturbance or removal of historical artifacts. Construction staff are also advised of the importance to report discoveries of new archaeological or historical information and artifacts, and to modify or cease activities in the vicinity of these finds until clearance is obtained from professional archaeologists and/or regulators.
- Camp Locations and Travel
Several companies indicated that wherever possible, camps and access routes to project sites are located away from the main settlements, and that personnel are moved directly to the work sites without spending time in the local communities. On the IPL pipeline, travel activities were largely confined to the Right-of-way (ROW). Off-ROW travel required approval by the Operations Manager.

3.2.2 Air Quality

Due to the small scale of existing oil and gas operations, and the emphasis on exploratory activity as opposed to production, few sources of air pollution currently exist in the planning region. In addition, because proven gas reserves are sweet (i.e., do not contain hydrogen sulphide), no major sulphur emission sources are anticipated in the near future.

If collector pipelines and a major transportation pipeline are constructed for natural gas, some air emissions could be released at the compressor stations (e.g., carbon dioxide, volatile organic carbons, nitrogen oxides). All of the major pipeline companies indicated that emission technology would be employed at all compressor stations, and that air emissions would meet or better provincial and territorial standards (e.g., TransCanada Pipelines 1986; Foothills Pipe Lines n.d.; Polar Gas n.d.). Monitoring of air emissions from compressor stations has also been proposed by one of the major gas transportation companies.

3.2.3 Noise

Compressor stations along the proposed natural gas pipelines were identified as one of the most significant noise sources associated with the pipeline projects. Based on project experience from the IPL Norman Wells Pipeline, noise impacts from new pipelines would be minimized by:

- Locating pumping and compressor stations away from human settlements, unless the communities indicate otherwise, and
- In areas where important human or wildlife concerns are identified, employing noise suppression measures such as intake silencing equipment, insulated enclosures around primary noise sources, exhaust silencers, ventilation silencers and acoustical insulation of exposed high pressure pipe

(e.g., TransCanada Pipelines 1986; Foothills Pipe Lines n.d.; Polar Gas n.d.).

3.2.4 Freshwater Quality

Freshwater quality is important to human settlements and the maintenance and conservation of renewable resources throughout the Mackenzie Delta and surrounding areas. In recognition of the importance of freshwater quality, the petroleum industry has funded or co-funded studies addressing current water quality and methods to maintain high water quality standards throughout the Mackenzie Delta and Beaufort Sea region.

The quality of freshwater resources in the planning region could be affected through activities associated with improper pipeline construction activities, use and disposal of drilling muds and oily wastes, disposal of routine solid and liquid wastes, treatment and transportation of hazardous wastes, and storage and transfer of fuel and oil.

Environmental protection measures employed by petroleum companies to minimize or eliminate the effects of these potential impacts within the planning region (e.g., Gulf Oil Canada et al. 1974; TransCanada Pipelines 1986; Gulf Canada Resources 1990c; Foothills Pipe Lines n.d.; Polar Gas n.d.) include:

- Pipeline Construction

Although some pipeline construction activities during the 1950s to 1970s did result in moderate impacts to water quality and aquatic ecosystems (e.g., sedimentation), new pipeline construction techniques has resulted in greatly improved environmental protection standards that have minimized or eliminated these impacts to water quality.

Disturbance of watercourses, wetlands and waterbodies has been largely eliminated by careful routing of the pipeline, and the inclusion of vegetation buffer zones (e.g., 50 - 100 m wide) between the pipeline ROW and adjacent water courses and water bodies.

Although most water crossings necessitate some disturbance of streambanks and stream beds during construction, effects are normally short-term due to measures such as:

- minimizing in-stream activity through the use of bridges, specified travel corridors across streams, use of winter ice crossings (note: these are generally broken up prior to breakup to prevent ice jams), use of flumes to maintain stream flow and fish passage, and good planning to keep the construction period as short as possible;
- spoil handling and storage to minimize streambank disturbance, contamination of ice with spoil, or in-stream sedimentation;
- maintenance of vegetation buffer areas on the streambank portion of the ROW for as long as possible prior to installation of the water crossing, and pulling back of soil and overburden materials from the streambank to avoid placing sediments in the water column; and
- scheduling of construction to minimize the overlap of any remaining water quality effects with periods of critical or important fish movements, spawning or egg incubation.

In at least one location along the proposed major pipeline routes from the planning region to southern markets, directional drilling will be used to install the pipeline crossings under a major river channel (e.g., the Great

bear River), thereby avoiding the need for trenching and disturbance of the river bed.

Water withdrawals for hydrostatic testing are normally limited to less than ten percent of the watercourse discharge, and intakes must be screened to prevent suction of fish and invertebrates. Water used for hydrostatic testing is often returned to the same watercourse using pressure diffusers to minimize stream bed erosion. Discharges onto land are sometimes permitted if existing vegetation will not be unduly affected by the discharge (e.g., some species of trees cannot tolerate flooding). If additives are present in the water (e.g., methanol, ethylene glycol), 24 hour static bioassays are employed to assess toxicity prior to discharge. All discharges must meet or better government regulations for water quality. If discharges are heated, water is generally allowed to cool prior to discharge.

- Drilling

Acceptable drilling muds and handling procedures for the planning region are specified by the Canadian Oil and Gas Lands Administration (COGLA) and Indian and Northern Affairs Canada. Effects of drilling muds and wastes on water quality and biota have been minimized through:

- Use of non-toxic drilling mud systems in almost all exploratory drilling programs;
- Specialized construction of drilling platforms to catch and contain spilled muds and lube oils for treatment;
- Proper selection and use of solids control equipment;
- Reduction of drilling fluid volumes to minimize sump volumes and size;
- Testing, treatment and dilution of drill cuttings and spent mud prior to discharge to meet or better government standards (e.g., COGLA guidelines);
- Total containment of drill wastes in on-land sumps;
- Use of small deep sumps as opposed to broad shallow sumps to minimize land disturbances; and
- Positioning of drilling rigs away from watercourses and waterbodies (e.g., 100m minimum), and use of vegetation buffer zones to reduce potential effects of runoff contamination.

- Routine Waste Disposal

Federal legislation, including land use permitting, strictly defines the types of treatment and standards that must be met for routine solid and liquid waste disposal (hazardous waste handling is discussed under the next heading). Potential contamination of water from waste disposal is minimized or eliminated through:

- Treatment of sewage from large stationary camps prior to disposal. Treated waste from such camps may be incinerated or landfilled. Sewage from small temporary camps (e.g., seismic exploratory drilling) is commonly deposited in a temporary sump, frozen back and capped to ensure total containment. Liquid wastes from construction and drilling are also treated to meet or better government standards.
- Control, handling and disposal of all camp garbage and non-hazardous construction waste. Food wastes are often kept in tight metal containers (primarily to avoid attraction of wildlife). Food waste and combustible

construction waste is commonly collected daily and incinerated. Non-combustible construction and camp waste (excluding hazardous wastes) and incinerator ash is hauled to designated landfill sites.

- In most projects, metal drums are repeatedly reused. In some larger projects, unusable metal drums are washed, crushed and recycled. Waste water from the steam cleaning or washing process is collected and treated prior to discharge.

- Hazardous Waste Management

Handling and storage of all fuels, waste oils, and hazardous waste must meet or better applicable legislated federal guidelines. All shipments of hazardous wastes are completed in accordance with the *Transportation of Dangerous Goods Act*.

No disposal of products such as waste oils, other petroleum products, hazardous chemicals, (e.g., solvents, greases, isocyanate, and pesticides) is permitted in sanitary landfills. Waste oil products are stored in tanks or containers, rather than in open earthen pits.

Oily wastes are generally treated and incinerated. For example, at Gulf's Nalluk base, waste oils, fuels and solvents are transferred to a bermed, open top tank to allow solids to settle out of the oil (Gulf Canada 1990c). Water is removed for treatment, whereas the oil is transferred to a second tank for further oil/water separation. Following this separation, the oil slop is agitated for feeding to a Saacke burner. The oily water is disposed of through evaporation and the remaining oil is incinerated. Oil contaminated waste (e.g., saturated sorbents, oily rags, oil filters) is incinerated and the ash disposed of in designated landfill sites.

Waste glycol is recycled by some operators. Waste glycol that is not reused, may be treated using the same technique as for oily water (above).

Waste chemicals cannot be satisfactorily disposed of in the planning region. They are normally stored in hazardous waste storage compounds, and following classification, documentation and packaging, are transported to out-of-Territory registered waste disposal facilities.

Pyrotechnics such as hand, parachute and smoke flares, are collected and stored in appropriate sites (e.g., steel magazines). Following Department of Transport Approval, they are manually discharged on a regular (e.g., annual) basis.

- Accidental Spills

The potential for degradation of water through accidental spills of fuels or oil is minimized by:

- Implementation and improvement of preventative measures that minimize the risk of accidental spills,
- Maintaining high operational standards during all oil and gas activities to minimize the potential for equipment failures (e.g., daily inspections of tankage and containment berms, weekly aerial inspections of pipelines),
- Training of personnel to ensure that all realistic precautions are employed during fuel transfers or drilling activity,
- Locating high risk facilities away from watercourses and waterbodies

- Use of specialized equipment to minimize the chance of fuel spills during refueling or fuel transfer operations,
- Use of pipeline shut-off valves to minimize oil or gas leaks in the event of a pipeline rupture.
- Maintenance of containment berms and site drainage systems to contain possible spills and direct spilled fuels and wastes to appropriate collection sumps, respectively, and
- Development and implementation of oil spill contingency plans to contain, recover and cleanup accidental spills (e.g., Shell Canada 1986; IPL 1987b, n.d.[b]).

As required by COGLA, all oil and gas operators must develop an oil spill contingency plan that outlines specific procedures in the event of an accidental spill of hydrocarbons (e.g., Shell Canada Limited 1986). Typical components of an oil spill contingency plan include: the organization and responsibilities of the response team, procedures for notification of government contacts and local organizations, reporting requirements, safety concerns, public relations, initial response procedures, equipment inventories, spill containment (on land, rivers and lakes), shoreline protection, identification of sensitive environmental and cultural sites, cleanup techniques (for land, water and shorelines), and treatment and disposal of recovered materials.

All operators must be members of an oil spill cooperative. In the planning region, the Beaufort Sea Oil Spill Cooperative maintains a large inventory of spill containment and recovery equipment at Tuktoyaktuk. In addition, the Canadian Coastguard as well as each operator maintains an inventory of spill containment and recovery equipment. Depending on the size and severity of the spill, one or more sources of equipment may be utilized.

The Oil Spill Coop and operators undertake one or more spill response exercises each year.

3.2.5 Marine Water Quality

At the present time, the only offshore activity in the planning region is exploration drilling for oil and gas, including support vessel movements. Future developments would include offshore production of oil and gas, and transport of hydrocarbon products by subsurface pipelines to production and collection facilities onshore.

Although water quality (and habitats) in nearshore and offshore marine areas could be affected by improper disposal of solid and liquid routine wastes and hazardous wastes, accidental spills of gasoline and diesel oil during refueling, oil discharge during stack flaring, and oil and gas blowouts, petroleum operators have worked cooperatively with government agencies to develop and implement preventative procedures and guidelines. These operating guidelines and procedures have included routine waste management, hazardous waste management, relief well and oil spill contingency plans, and blowout prevention:

- Solid and Liquid Waste Management
Standards for handling and treatment of solid and liquid (non-hazardous) wastes in nearshore and offshore areas are specified in federal legislation such as the *Canadian Arctic Shipping Pollution Prevention Regulations* (CASPPR) and *Offshore Waste Treatment Guidelines*. Offshore operators

have also developed manuals for waste management and marine operations (e.g., Gulf Canada Resources).

Protection procedures for handling and treating of solid and liquid wastes are similar to those already described for fresh water quality, except that non-combustible waste and incinerated ash is packaged for transport to designated landfill sites, and treated liquid effluent and grey water is normally discharged through a discharge caisson or similar structure. All discharges must meet or better government water quality standards.

- Hazardous Wastes

All offshore drilling structures in the Beaufort Sea include drainage systems which eliminate direct drainage from all floor, deck and equipment drains to the ocean. For example, on the Gulf Canada's Kulluk, all drains (with the exception of the quarter's floor drains) drain to the oily water separator (Gulf Canada 1990a).

All hazardous wastes on offshore vessels and islands are stored, documented and packaged according to the *Transportation of Hazardous Goods Act*, and are transported to land based facilities for appropriate treatment (e.g., incineration or transport to registered waste management facilities; see Section 3.2.4).

Drilling muds and cuttings from offshore drilling operations are generally disposed of at sea following treatment to meet accepted standards. As discussed above, non-toxic gel muds are preferentially used to minimize costs, reduce mud storage requirements, and minimize environmental effects.

- Accidental Oil Spills

Minor onboard oil spills can be contained by the drainage system (see above). Minor oil sheens are produced by the flare booms on most drilling platforms during well testing activities, but improved igniters and wind screens have reduced the amount of oil released in this manner.

All offshore operators have oil spill contingency plans that address spill responses, containment and recovery measures, reporting requirements, and government contacts (e.g., ESSO Resources Canada 1989; Amoco 1990; Gulf Canada Resources 1990d). Details on offshore oil spill contingency plans are provided in the following description (oil and gas blowouts).

- Oil and Gas Blowouts

For human safety, economic and environmental reasons, all offshore operators implement a large number of precautionary measures to minimize the potential for an oil or gas blowout. Measures include regular equipment testing, maintenance and upgrading, personnel training and practice drills, mud monitoring, detailed planning of the drilling, evaluating and abandoning programs, use of techniques to establish formation pressure prior to penetration, contingent quantities of casings and consumables, and specialized safety equipment such as blowout preventers. These measures collectively result in a very low probability of a blowout during drilling operations.

In the event that an oil or gas blowout occurs in conjunction with offshore drilling operations, all operators have prepared contingency plans for oil spills, relief well operations, and emergency responses. Response exercises and staff training are conducted at regular intervals to ensure that spill and emergency responses can be implemented in an efficient and effective manner. All offshore operators are members of the Beaufort Oil Spill Cooperative.

COGLA requires that all operators develop and implement an oil spill response plan (e.g., Amoco 1990; Gulf Canada Resources 1990). Components of offshore oil spill response plans are similar to those already described for spill responses in freshwater areas. In general the oil spill responses focus first on containment and recovery at the drill site. In the event that oil moves onshore, coastline protection measures would be initiated in vulnerable and sensitive environmental and cultural sites. If fouling of shoreline areas occurs, shoreline cleanup measures would be initiated (e.g., Harper 1990).

A number of information sources have also been compiled to assist in shoreline protection and cleanup responses. The Beaufort Sea Coast Video Tapes were developed to provide visual information on coastline topography for all of the Beaufort Sea coast between Demarcation Point and Cape Bathurst. The Environmental Atlas for Beaufort Sea Oil Spill Response (D.F. Dickins Associates Ltd. and ESL Environmental Sciences Limited 1987), provides environmental and cultural sensitivity maps for the entire coastline from Herschel Island to the Baillie Islands.

3.2.6 Terrain and Soils

Based on experience gained in the construction of pipelines and other facilities in areas to the south of the planning region (e.g., the IPL Norman Wells - Zama pipeline), as well as recent operations in the planning region (e.g., seismic exploration, exploratory drilling)(e.g., Gulf Oil Canada et al. 1974; TransCanada Pipelines 1986; Gulf Canada Resources 1990c; Foothills Pipe Lines n.d.; Polar Gas n.d.), a number of measures can be employed to substantially reduce or eliminate terrain and soil disturbances associated with improper clearing of vegetation and grading blasting, machinery operation, alteration of drainage, surface erosion, and reclamation:

- Maximize Use of Existing Sites and ROWs
Wherever practical, existing disturbed sites are used for siting of facilities. Existing ROWs have also been used for seismic exploration. Major pipeline proponents are also in favour of a single "energy corridor" instead of separate (and widely separated) corridors for oil and gas pipelines and electrical transmission lines.
- Routing of ROWs
ROWs for collector pipelines and the main pipeline would minimize the number of sensitive stream crossings, and avoid erosion-prone terrain (e.g., ice-rich permafrost) and sensitive ecological and cultural sites, including important wildlife habitats and harvesting areas. Avoidance could involve modifications to the pipeline routing, as well as construction during less sensitive periods (e.g., winter). Seismic lines and exploration access routes typically avoid erosion-prone terrain.

- Winter Construction
Due to logistical constraints, most facility construction has or would occur during the winter when access can be provided on snow or ice roads. Such scheduling minimizes terrain and soil disturbance associated with all-weather access roads, ensures good trafficability, and provides a stable work surface.
- Machinery Operation
During construction of facilities and pipelines, vehicle use is restricted to the designated travel corridors or along the pipeline ROW. Following pipeline construction, however, vehicle use may be prohibited along the ROW (using physical impediments such as roll-back) to minimize terrain disturbances and promote revegetation.
- Permafrost Protection
During construction of the IPL pipeline, a number of methods (e.g., thick layers of woodchips produced largely from salvaged trees) were developed or improved for protection and restabilization of ice-rich soils in permafrost and discontinuous permafrost areas (IPL 1987a, 1988, 1989). Gas will be refrigerated in sections of pipelines that are located in permafrost areas to prevent melting and subsidence (Polar Gas n.d.).
- Maintenance of Drainage Patterns
On pipeline ROWs, natural drainage patterns across the ROW will be maintained whenever possible to avoid ponding of water, slope instability and soil erosion. Great care also is taken during seismic and exploratory drilling operations to maintain natural drainage patterns.
- Grading and Soil Handling
In most site facilities and along ROWs, disturbance of vegetation covers and topsoil is minimized to reduce problems in permafrost areas, as well as reclamation requirements. Vegetation buffer zones will also be maintained along watercourses and waterbodies. In areas with adequate topsoil layers, topsoil may be salvaged and stockpiled for later use in reclamation.
- Drilling Platforms
During recent land-based drilling operations, several types of temporary platforms have been used to minimize gravel requirements and to reduce permanent impacts to terrain and soils. Measures that have been used successfully include rig matting, pilings and temporary platforms, use of insulated geotextile fabrics to reduce gravel requirements for drilling platforms, and temporary ice platforms (use of this measure is restricted by the relatively short season of use). In exceptionally sensitive areas, helicopter-supported drilling may be used in conjunction with these measures to prevent terrain disturbances. Tanks have also been used to store drill wastes and reduce requirements for ground sumps.

Directional drilling techniques are useful in increasing the number of wells that can be established from a single drilling platform, thereby reducing the amount of terrain disturbance in producing a producing field.
- Reclamation
All operators are required by legislation to reclaim disturbed sites following completion of the project. The petroleum industry was instrumental in

developing new reclamation techniques for northern areas including methods for topsoil replacement, use of erosion control measures (e.g., fabrics, mulches), use of certified seed to reduce weed problems, and development of commercially viable sources of northern native seed for grasses and forbs.

3.2.7 Fisheries

The petroleum industry has completed or co-funded a wide range of fisheries studies to obtain data on fish abundance, population structure, diversity, distribution, habitat use, spawning behaviour, and seasonal movement patterns. Input from local residents has helped expand this data base. A substantial body of information is now available for most areas to assist in the planning and implementation of environmental protection measures to reduce impacts to fish and fish harvesting activities. With future developments, field studies will be completed as necessary to better define important seasonal windows for fish activity, as well as important habitat areas.

Freshwater and anadromous fish in the planning region could be affected by oil and gas developments through improper procedures which change water quality (see Section 3.2.4), disturb important spawning or overwintering habitat, create barriers to fish movements, and increase fishing pressure associated with increased numbers of people.

Measures employed by oil and gas projects within the planning region (e.g., Gulf Oil Canada et al. 1974; TransCanada Pipelines 1986; Gulf Canada Resources 1990c; Foothills Pipe Lines n.d.; Polar Gas n.d.) include:

- Scheduling of Construction
Based on information from environmental studies, construction windows have now been defined for many activities to avoid critical life phases for important fish species (e.g., spawning, egg incubation, overwintering).
- Avoidance of Sensitive Habitats
Environmental studies, as well as input from local residents have helped delineate important habitat areas for fish that must be protected at all times or during specific seasons during the year.
- Maintenance of Water Quality
As discussed in Section 3.2.4, a large number of measures are employed to minimize sedimentation and to maintain water quality in watercourses and waterbodies. Contingency plans have also been developed to contain and recover spills or hazardous wastes and hydrocarbons. Because a twin pipeline can be installed in a river crossing with little more disturbance than a single line, some pipeline companies are proposing to construct double pipeline crossings on some rivers to reduce future disturbances of these watercourses. One pipeline would be used for the current line, whereas the second pipeline would be used in the event of future looping of the pipeline.
- Maintenance of Fish Passage
Potential barriers to fish passage are minimized through use of culverts during construction of water crossings, use of snow fill under ice bridges to maintain water flow under the ice bridge, destruction of ice bridges (including removal of the snow fill) prior to breakup, and minimizing water withdrawals (particularly during periods of fish movement).

- Training of Personnel

Training of personnel is important in limiting the potential for in-stream disturbance, accidental fuel spills and maintenance of water quality. Northern training courses are also useful in minimizing the risk of over-fishing.

3.2.8 Terrestrial and Marine Wildlife

Since the initial exploration activities for oil and gas in the planning region, the petroleum industry has funded or co-funded a large number of field studies to obtain information on the abundance, distribution, population structure, seasonal movement patterns, and habitat use of mammals and birds. A number of studies have addressed the effects of oil and other contaminants on terrestrial and marine wildlife. A substantial body of research has also been completed on traditional harvesting of mammals and birds by local residents. Information from these studies have been extremely useful in identifying and refining measures to reduce or eliminate impacts to wildlife, as well as identifying future research needs.

Terrestrial and marine wildlife may be detrimentally affected by oil and gas developments through improper procedures which result in loss or destruction of important habitats, sensory disturbance, barriers to movements, acute and chronic contamination by oil or hazardous wastes, and increased mortality through road kills and hunting.

General and specific measures that are useful in eliminating or reducing impacts to specific groups of terrestrial and marine wildlife are described below.

3.2.8.1 General. A number of general measures are utilized by oil and gas projects to spatially or temporally avoid conflicts with wildlife (e.g., Gulf Oil Canada et al. 1974; TransCanada Pipelines 1986; Gulf Canada Resources 1990c; Foothills Pipe Lines n.d.; Polar Gas n.d.) such as:

- Avoidance of Critical Habitat

Routing of ROWs and facility sitings will avoid critical habitat areas (e.g., overwintering areas for ungulates, nesting, brood rearing and staging habitat for birds).

- Avoidance of Important Life Phases

Construction activity or intense human activity in critical and important wildlife habitats can be scheduled to avoid periods of peak wildlife use. For example, some segment of the IPL Pipeline between Norman Wells and Fort Simpson were constructed during winter to avoid sensory disturbance of high concentrations of birds of prey during the spring nesting period (IPL 1987b; n.d.[a]).

- Reduction of Sensory Disturbance

Sensory disturbance of wildlife has been reduced by minimizing the number of vehicles and vehicle movements, restricting vehicle movements to designated travel corridors, use of flight corridors and minimum altitude restriction (e.g., 300-600m AGL) for corporate and contract aircraft, noise reduction measures for stationary equipment (e.g., compressor stations)(see Section 3.2.3) and vehicles, and scheduling and location of blasting.

- Vehicle Movements on ROWs
Some companies have identified important wildlife movement areas along and across ROWs, and have identified these areas to their personnel to reduce the potential for wildlife-vehicle collisions.
- Garbage Disposal
To minimize attraction of wildlife such as birds, foxes, wolves and bears to camp areas, food waste is placed in tight metal containers and is incinerated daily.
- Hazardous Waste Disposal
Storage and handling of hazardous wastes is strictly controlled in all oil and gas projects. Storage areas are generally fenced to prevent entry of wildlife, and hazardous materials are kept in sealed metal containers.
- Hunting and Trapping
Firearms are not permitted to be carried by any personnel except the polar bear monitors and other designated personnel. Southern based staff are also prohibited from having firearms on company property, including living accommodations, aircraft and vehicles.
- Personnel Training
Most companies require most of their staff to complete a northern training course that includes information on northern wildlife and methods to prevent or reduce impacts to these species, and northern cultures.
- Monitoring
Some companies have employed local residents to monitor the environmental aspects of wildlife to project activities, and to provide additional recommendations on minimizing effects to wildlife and traditional wildlife harvesting by local residents.

3.2.8.2 Birds. Environmental protection procedures for birds have included measures to reduce sensory disturbances of nesting birds of prey and waterfowl. A bird protection plan is also being developed to minimize effects of routine drilling operations and oil spills on marine and coastal birds. Transport Canada regulations prohibit low flights over migratory bird sanctuaries and harvest areas (Transport Canada 1980).

- Nesting Birds of Prey
During construction of the IPL Norman Wells - Zama pipeline, known concentration areas for nesting birds of prey (e.g., hawks and eagles) were protected from 15 April to 15 September. Air travel was minimized in the vicinity of the nests (IPL 1987b, n.d.[b]). During current maintenance inspections, patrol flights must remain on the ROW and, in the vicinity of nests, only single passes are permitted and flight speeds are reduced. Non-patrol aircraft must maintain a minimum altitude of 760 AGL and, if forced to fly lower, fly around known nest areas.
- Waterfowl
IPL also required aircraft to avoid specific waterfowl migratory routes (IPL n.d.[b]). Aircraft restrictions, similar to those described for birds of prey, were in force during construction and are currently used during inspection patrols.

Operators in the Norman Wells region have also developed an oil spill contingency plan to reduce impacts to waterfowl. The plan describes techniques for oil spill containment and recovery, as well as procedures for capture and treatment of oiled birds (IPL n.d.[b]).

- Coastal Bird Protection Plans

A first draft of a bird protection plan for the Gulf Canada drilling program was recently completed in the summer 1990 (Green 1990). The plan addresses potential effects on marine and coastal birds from routine operations and oil spills.

3.2.8.3 Terrestrial Mammals. Specific environmental protection measures for terrestrial mammals have focussed primarily on ungulates (in relation to pipelines) and on polar bears and grizzly bears (in relation to worker safety, oil contamination and minimizing the need for destruction of problem animals). Most of the general measures described above have been or will be used to minimize impacts to terrestrial wildlife.

- Blockage of Ungulate Movements

During construction of the prebuild portion of the Foothills pipeline, specifications were developed to minimize the potential for creating barriers to local or seasonal movements of ungulates (primarily moose)(Foothills Pipelines n.d.). Recommendations included construction activities only during daylight hours, construction of the pipeline in segments, placement of pipe sections, welded pipe and spoil piles in sections no longer than 900m, and placement of soft ditch plugs coincident with the gaps in the pipe and spoil berms to permit animal movements. In areas of known ungulate concentrations, breaks in the pipe strings, spoil berms and open ditch were more frequent.

- Bear Protection Plan

In conjunction with its drilling program in 1989-1990, ESSO Resources Canada developed a bear protection plan in cooperation with N.W.T. Game Branch, local HTC's, IGC, WMAC/NWT and WMAC/NS (ESSO 1989). The plan describes procedures for (1) detecting and deterring polar and grizzly bears from the drilling location during normal operations, and (2) detecting and deterring polar bears from a drilling location during an oil spill and/or blowout. The plan also describes procedures for treatment of oiled bears (e.g., capture, de-oiling and veterinary care). Involvement of local residents is an important component of the plan.

- Non-destructive Deterrence of Bears

The Government of the N.W.T. (Renewable Resources) and industry have co-funded a program to assess bear-human conflicts and develop procedures to minimize the potential for conflicts and the need for destruction of problem bears (Bromley 1985). Aspects considered have included methods of avoiding bear-human problems, recommended designs for work sites and camps, bear detection systems, and non-destructive bear deterrent methods.

3.2.8.4 Marine Mammals. Environmental protection measures for marine mammals have focussed primarily on beluga (white) whales. These measures have been summarized in protection plans for the Beaufort Sea region which address aircraft and ship disturbances to beluga whales.

- Oil and Gas Procedures to Prevent Interactions with Beluga Whales and Whale Hunters

This protection plan generally describes the overall policy of the offshore operators (Dome Petroleum et al. 1986) to minimize conflicts between white whales and their aircraft or vessel operations. The plan recommends avoiding beluga whale concentration (e.g., Niakunak Bay, Pelly Island, Kugmallit Bay) during late June to August when local harvesting activity is most common. It also recommends the use of specific aircraft corridors, as well as a minimum flight altitudes.

- Beluga Whale Protection Plan

Gulf Canada's beluga whale protection plan (Gulf Canada Resources 1990b) was developed in cooperation with members of the Inuvik and Tuktoyaktuk HTC's and the Fisheries Joint Management Committee. The plan describes procedures for locating beluga whales prior to the breakout of the icebreakers and the Kulluk from Herschel Island, and modifying the course of these vessels en route to the drilling area to avoid concentrations of beluga whales.

4.0 RECOMMENDATIONS AND CONCLUSIONS

4.1 RESOLVING POTENTIAL INDUSTRIAL IMPACTS

Since the start of oil and gas exploration in the Mackenzie Delta - Beaufort Sea region over thirty years ago, levels of seismic exploration and exploratory drilling have undergone dramatic fluctuations ranging from little or no activity to intense activity as experienced in the early 1980s. Throughout this period, the petroleum industry has undertaken a wide range of research to improve exploration and construction techniques, establish information on environmental and cultural resources, and develop better methods for reducing impacts to environmental and cultural resources. Consultative processes with local organizations and governments such as local HTC's, HTAs, hamlet councils, the Gwich'in Tribal Council, the IGC, the FJMC, the WMAC/NWT and WMAC/NS have also been established and substantially improved during this period.

Although some environmental problems such as accidental small spills of oil, a shallow gas blowout and unintentional conflicts with local harvesting activities have occurred, no significant long-term impacts to environmental or cultural resources have been identified during this period of exploratory activity. This is not to suggest that petroleum activities cannot affect environmental and cultural resources, but rather that the petroleum industry, in cooperation with local residents and government, have been able to implement procedures to identify and resolve real and potential conflicts before serious damage to these resources has occurred.

The ability of local governments and residents, territorial and federal governments and the petroleum industry to achieve this success has been strongly dependent on several factors:

1. Local residents possess a keen knowledge of environmental and cultural resources in the region, and through cooperative consultative processes, have been able to identify concerns for impacts to these resources at the design phase for many recent petroleum projects.
2. Independent and cooperative scientific research by the federal and territorial government, industry and universities has resulted in the establishment of a substantial body of technical information pertaining to the abundance, distribution and ecological requirements of important biological resources in the Mackenzie Delta and Beaufort Sea, as well as the physical environment. This data base has been instrumental in the development of protection measures and the identification of future research needs. Ongoing research, such as that supported by the Environmental Studies Research Fund, is now addressing some of the priority information needs.
3. Many measures which are of economic importance to petroleum development in the planning region have significant benefits to environmental protection. For example, a failure in a large diameter pipeline during the summer period could shut down the pipeline until the following winter. Measures to ensure pipeline stability and minimize erosion are not only important in minimizing environmental damage, but are equally important in minimizing long-term operational costs for a major pipeline project. Similarly, measures to reduce the risk of a well blowout, have both economic and environmental benefits to oil and gas production.

4. The need for effective mitigation of environmental impacts has promoted cooperative efforts by biologists, engineers and planners to improve and develop environmental protection planning procedures.
5. Cross-cultural training of southern personnel for petroleum projects has increased their awareness of the attitudes, culture and history of northern peoples, and has helped reduce some of the earlier conflicts between northern residents and project personnel.
6. Local residents, municipal, territorial and federal governments and industry have been willing to develop and improve mechanisms for effective communication and resolution of conflicts. Consultative processes have brought important stakeholders together to resolve existing and future problems. The recent development of environmental protection plans for bears and beluga whales are two examples of how potential conflicts can be resolved through a consultative approach to the decision-making process.

4.2 EXAMPLES OF PETROLEUM-BASED ACTIVITIES AND THE PROPOSED LAND MANAGEMENT REGIMES

As described in this report, public consultation procedures and environmental protection planning measures have been developed and implemented in conjunction with a diverse and large number of petroleum exploration projects in the Mackenzie Delta and the southern Beaufort Sea. The methods used to minimize or eliminate impacts of petroleum activity on cultural and environmental resources can be grouped into three major categories:

- changes in exploration or construction procedures to minimize physical disturbances;
- changes in the timing of exploration or construction activities to avoid sensitive periods for cultural and environmental resources; and
- changes in the location of facilities or routing of linear rights-of-way to avoid sensitive cultural and environmental areas.

In the latter category, changes in locations may be local (e.g., up to 100's of metres) or even regional, depending on the sensitivity of the resources, as well as the type of petroleum activity. In many cases, all three types of protection procedures are used within the same project to ensure that all possible impacts are eliminated.

The land management regimes proposed by the Planning Commission recommend the use of procedural, timing and locational constraints for specific land use activities (see Section 1.1 and Appendix 6.1). In the case of extremely sensitive resources, no human activity will be permitted. These proposed constraints on land use are very similar to many of the environmental protection procedures that are already employed by the petroleum industry. Examples of environmental protection procedures which are currently used by the petroleum industry in the planning region that are compatible with the five proposed land use regimes are provided in Table 3.

4.3 CONCLUSIONS

Based on this review of options for integrated resource management in the Mackenzie Delta - Beaufort Sea Planning Region, it is apparent that a wide range of measures have been used successfully by the petroleum industry in the planning region to minimize or eliminate impacts to environmental and cultural resources. However, given the uncertainty of present industrial activities in the planning region, the absence of long-term economic and employment alternatives for local residences, the reliance of local residents on traditional harvesting activities for a substantial portion of their food and annual incomes, and the significance of the environment in northern cultures, local residents want assurances that the renewable resources on which their traditional lifestyle depends will not be damaged by industrial activity in the planning region.

In recognition of the reliance of local residents on renewable resources, the wide range of measures and the success of environmental protection planning procedures in the planning region, and the efforts of the petroleum industry to cooperate with local residents and governments, it is concluded that:

1. Ongoing consultative processes involving local residents, agencies and governments, the territorial and federal governments and the petroleum industry are essential to the future resolution of potential conflicts and effective land use decisions in the planning region.
2. Recognizing the protected areas in the draft land use plan, these consultative processes should be used to develop conservation plans and land use guidelines for these areas that are acceptable to local residents, industry and governments. The proposed land management regimes offer an excellent base for development of effective multiple land use guidelines.
3. Environmental protection measures must continue to be effectively employed in all aspects of oil and gas development. Whenever possible, input from local residents, scientists and industry specialists should be used to improve existing techniques and to develop new procedures for environmental protection.

Table 3. Examples of environmental protection measures employed by the petroleum industry in the planning region that are compatible with the Commission's proposed land management regime.

Land Management Regime	Description of Land Category and Comparable Examples of Petroleum Activity
Group A:	<i>Multiple use lands where there are no particular significant or sensitive cultural or renewable resources; therefore, activities/development can proceed subject to current regulatory applications for multiple-use activities.</i> • Offshore (>20 km) exploration drilling in the Beaufort Sea has not been geographically or seasonally restricted. However, all operators impose strict guidelines for the treatment, handling and disposal of routine wastes, handling and transportation of hazardous wastes, and on-ice activity of personnel. A large number of precautions are undertaken to minimize the risk of accidental spills and blowouts and to maximize human and environmental safety. Non-toxic gel muds are preferentially used during exploration drilling. • Compressor stations for the proposed gas pipelines within the Mackenzie corridor will incorporate state-of-the-art air emission technology and noise suppression equipment. • Operational bases at Tuktoyaktuk employ strict standards for treatment, handling and disposal of routine and hazardous wastes, and spill containment procedures for all fuel transfers.
Group B:	<i>Multiple use lands where the cultural or renewable resources are significant or sensitive throughout the year, but where activities/development can proceed subject to the identification of special measures during the regulatory application process to ensure the conservation of these values.</i> • During construction of facilities or ROWs in areas of potential cultural or historical importance, a professional archaeologist may be retained to investigate potential finds and recommend appropriate on-site guidelines for preservation. • In order to minimize disturbances to sensitive water areas, a 50 - 100 m wide vegetation buffer area is routinely maintained between most ROWs and facility sites and adjacent watercourses or waterbodies.

..... Table 3 cont'd.

Table 3. Continued.

Land Management Regime	Description of Land Category and Comparable Examples of Petroleum Activity
Group B (cont'd)	• Within the Mackenzie Delta, normal drilling procedures include total containment of drill wastes in on-lease sumps, and treatment and dilution of drill cuttings and spent mud prior to discharge to meet or better government standards. • Rig matting, geotextile fabrics, temporary wooden platforms and pilings have been used in the Mackenzie Delta to minimize terrain disturbance and promote faster revegetation of drill sites. • Operators routinely use specific flight corridors and minimum flight altitudes between supply bases and drilling sites to avoid overflights of sensitive waterfowl habitats, and to minimize interference with migratory movements. • Spaces in pipeline construction strings may be employed to minimize blockages of wildlife movements.
Group C:	<i>Multiple use lands where cultural or renewable resources are significant or sensitive at particular seasons or times; therefore, activities/development should only proceed at other times of the year. Subsistence harvesting is permitted at any time of the year.</i> • In the vicinity of specific waterbodies or within specific sections of some watercourses, construction windows are routinely imposed on seismic and construction activities to avoid sensitive time periods (e.g., spawning, rearing, overwintering) for fish. • Winter construction of pipelines is preferred to minimize disturbance of sensitive terrain and to avoid disturbance of nesting birds (e.g., waterfowl, birds of prey). • Aircraft movements and altitudes may be restricted during the May to September period in the immediate vicinity (e.g., 1-3 km) of active nests for birds of prey. • No major movements of equipment or personnel to and from exploration drilling sites in the Kendall Island Bird Sanctuary has been permitted during the July and August period to avoid disturbances of nesting snow geese. Drilling occurs only in winter when migratory birds are absent.

..... Table 3 cont'd.

Table 3. Continued.

Land Management Regime	Description of Land Category and Comparable Examples of Petroleum Activity
Group C (cont'd)	• The beluga whale protection plans specify operational procedures for offshore vessel and aircraft activity during the June to August period to minimize disturbances to beluga whales and interference with the beluga whale hunt.
Group D:	<i>Limited use lands where cultural or renewable resources are very significant or sensitive year-round; therefore activities/development are not permitted that would threaten conservation of these cultural or renewable resources. Subsistence harvesting is permitted at any time of the year.</i> • Unless communities otherwise desire, compressor stations along the proposed gas pipeline will not be constructed within audible range of human settlements, important harvesting sites or cultural areas, or critical wildlife habitats. • No construction activities will be permitted within or directly upstream of important fish habitats for spawning, rearing of young or overwintering. Where the pipeline ROW will cross a major watercourse in proximity to such sites (e.g., Great bear River), directional drilling under the watercourse may be used instead of trenching to install the underground pipe (Note: this technique is only practical in areas with rock substrates). Bridge crossings of the watercourse may be used to avoid vehicle traffic in the river or stream bed. • Fuel storage, refueling and equipment maintenance activities are routinely not permitted within specified distances of watercourses and waterbodies. • Pipeline routings are kept away from important cultural and historical sites and, wherever possible, locally avoid critical wildlife habitat areas (e.g., Rat River, Travaillant Lake). Where physical avoidance is not feasible, construction may require special precautions and may be scheduled to avoid critical time periods for harvesting and wildlife. • Unless communities otherwise desire, camps and facilities will be located away from existing human settlements in the planning region. Access by southern staff to community facilities will be determined by the local communities.

..... Table 3 cont'd.

Table 3. Concluded.

Land Management Regime	Description of Land Category and Comparable Examples of Petroleum Activity
Group E:	<i>Limited use lands where cultural or renewable resources are extremely significant or sensitive; therefore no human activity is permitted, including tourism. Subsistence harvesting is suspended for public safety or conservation in accordance with IFA and Dene/Metis Agreements. Limited research is permitted.</i> • No facilities will be constructed on or near important cultural sites such as graveyards or significant archaeological sites. • No facilities or ROWs will be permitted in the vicinity of unique geological features such as pingos.

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6.0 APPENDICES

6.1 PROPOSED COMPREHENSIVE SYSTEM OF LAND MANAGEMENT

VOLUME 2 OF TWO VOLUMES

A COMPREHENSIVE SYSTEM OF LAND MANAGEMENT

(A Draft Table of Contents, 23 October 1990)

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 - 3.1 **Multiple use lands**

[Lands where activities can proceed subject to certain measures intended to ensure conservation of renewable and cultural resources; these are most lands in the planning region.]

Group A - Lands where there are no particularly significant or sensitive resources and therefore, only require usual application of regulations for multiple-use activities. The Commission is confident that existing processes can protect important resources.

EXAMPLES: 1. Offshore Beaufort Sea beyond 20 km.

Group B - Lands where the resources are sensitive or significant throughout the year but where development can proceed with special attention paid to their values in the application of regulatory processes.

EXAMPLES: 1. Aklavik: #10 Culturally Important Sites.
2. General: Significant Habitat e.g. spawning grounds for charr.

Group C - Lands where resources are significant or sensitive at particular seasons or times; therefore development activities should only

occur at other times of the year, when the usual regulatory processes would apply. Subsistence harvesting permitted at any time of the year.

EXAMPLES: 1. Sachs Harbour, #7; Holman #2: Prince of Wales Strait
KNOWN CONFLICT: SHIPPING THROUGH THE STRAIT.

3.2 Limited use lands

[Areas where cultural or renewable resources are so significant and/or sensitive that the Commission believes they should be designated as protected areas where certain activities are excluded throughout the year.]

Group D - Areas where resources are very significant or sensitive year round; therefore activities are not permitted that would threaten conservation of the cultural and renewable resources. Subsistence harvesting permitted at any time of the year.

EXAMPLE: 1. Sachs Harbour #9: Thomsen River Area.
KNOWN CONFLICT: Tourism.
2. Ft. McPherson #1: Rat River Area.
KNOWN CONFLICT: Highway/pipeline corridors.
3. Arctic Red River #1: Travaillant Lake
KNOWN CONFLICT: Highway/pipeline corridors.

Group E - Lands where resources are extremely significant or sensitive; therefore no human activity is permitted (including tourism). Subsistence harvesting suspended for public safety or conservation in accordance with IFA and Dene/Metis Agreements. Limited research permitted.

Note: Areas could be temporarily assigned to this category.

EXAMPLE: 1. all known archaeological sites

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